Attorney Docket: 132/42381CO
PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant: LAWRENCE ROBERT GRZYLL ET AL.

Serial No.: 08/895,687 Group Art Unit: 1721

Filed: JULY 17, 1997 Examiner: J. ANTHONY

Title: FIRE EXTINGUISHING METHODS AND BLENDS UTILIZING UNSATURATED PERFLUOROCARBONS

APPEAL BRIEF

Assistant Commissioner for Patents
Washington, D.C. 20231

Sir:

This Appeal Brief is submitted in triplicate in accordance with 37 C.F.R. §1.192 together with the requisite fee set forth in 37 C.F.R. §1.17(f).

I. INTRODUCTION

This Appeal is from a final Office Action mailed December 10, 1998, finally rejecting Claims 8-13 and 27-33 of the above-identified patent application. No claims are allowed.

A. REAL PARTY IN INTEREST

The real party in interest for this Appeal is Mainstream Engineering Corporation, by way of an assignment recorded in the U.S. Patent and Trademark Office at Reel 7634, Frame 0381.

B. RELATED APPEALS AND INTERFERENCES

Applicants and Applicants' representatives are not aware of any other appeals or interferences that will directly affect or be directly affected or have a bearing on the Board's decision in the pending Appeal.

C. STATUS OF CLAIMS

Claims 8-13 and 27-33 are pending herein and stand rejected. The claims are set forth in the attached Appendix.

D. STATUS OF AMENDMENTS

An Amendment After Final Rejection was filed on March 5, 1999, in which Claims 8-13 and 27-28 were canceled. In an Advisory Action mailed March 16, 1999, the Examiner indicated that the Amendment would be entered upon filing a Notice of Appeal and an Appeal Brief. However, Applicants respectfully request that the claim amendments not be entered. Thus, the Appeal Brief is directed to finally rejected Claims 8-13 and 27-33.

In addition, an Amendment After Final Rejection is filed concurrently herewith to provide proper antecedent basis in Claims 12-13.

II. SUMMARY OF THE INVENTION

Halogenated chemical agents containing combinations of fluorine, chlorine, bromine, iodine, and hydrogen are well known. Such chemical agents include Halon 1301 (CF_3Br), Halon 1211 (CF_2ClBr), and Halon 2402 (CF_2BrCF_2Br) (specification at page 1, lines 4-12). However, these fire extinguishing agents are believed to be capable of destroying the ozone layer (specification at page 2, lines 1-2). They are also thought to contribute to global warming because their atmospheric lifetime is sufficiently long that they persist in the atmosphere and absorb solar radiation.

The present invention is directed to fire extinguishing methods using a fire extinguishing agent that surprisingly has similar volatility, residue levels, material compatibility and safety characteristics as Halons. More importantly, the fire

extinguishing methods of the present invention are environmentally acceptable (specification at page 2, lines 21-26).

The claimed fire extinguishing methods use octafluoro-2-butene ($CF_3CF=CFCF_3$) alone or in combination with other fire extinguishing agents. Octafluoro-2-butene may be used not only in total flooding applications, but also in portable fire extinguishing equipment (specification at page 4, lines 1-7). Because octafluoro-2-butene is unsaturated, it is susceptible to breakdown in the lower atmosphere, and thus does not pose a threat as a greenhouse warming gas. In addition, because octafluoro-2-butene contains no chlorine or bromine, it has zero ozone depletion potential (specification at page 3, lines 5-10).

III. THE APPLIED REFERENCES

The applied references are Japanese Patent Application 5-42230 ("JP '230"); Pitts et al., "Construction of an Exploratory List of Chemicals to Initiate the Search for Halon Alternatives" ("Pitts"); U.S. Patent No. 5,117,917 ("Robin"); and optionally the Preliminary Amendment and Declaration filed on February 10, 1998.

A. JP '230

JP '230 discloses fire extinguishing agents that contain at least one of (1) a chain-form or branch-form saturated halogenated hydrocarbon with 1-4 carbon atoms replaced with fluorine and/or chlorine; (2) a cyclic saturated halogenated hydrocarbon with 3-4 carbon atoms and replaced with fluorine; and (3) a chain-form or branch-form unsaturated carbon

fluoride with 3-4 carbon atoms and a double bond (translated numbered paragraph [0009]).

As noted in the final Office Action, JP '230 does not disclose octafluoro-2-butene. In fact, the only unsaturated carbon fluoride disclosed is hexafluoropropene (i.e., $CF_3CF=CF_2$). See translated numbered paragraph [0013]. JP '230 also states that the disclosed fire extinguishing agents do not destroy the ozone layer, unlike agents containing bromine. See translated numbered paragraphs [0002]-[0004].

B. Pitts

Pitts details the results of a literature search on combustion suppression, flame inhibition and fire retardancy and identifies nine chemical families with the potential for workbench testing. One of the nine families is unsaturated halocarbons (page 54).

With respect to unsaturated halocarbons, Pitts indicates that the presence of a double bond and a bromine atom may shift the absorption spectrum of a particular compound toward the red and thus give photolysis a chance to destroy the gas before it migrates into the stratosphere (page 54). Pitts further states: "Assuming a special role for bromine in fire suppression, custom synthesis will be necessary to place bromine in a variety of positions and exploit the special effects introduced with the presence of a double bond" (page 54, fourth paragraph, emphasis added).

Throughout prosecution the Examiner has pointed to Table 7 to assert that Pitts teaches octafluoro-2-butene (i.e., perfluorobutene-2). However, when referring to the compounds disclosed in Table 7, Pitts indicates that although the first

six compounds are commercially available, none contains a bromine group. Thus, "custom synthesis will be necessary to widen the range of possibilities . . . the molecules which have been added to Table 7 will be particularly interesting" (page 55). Because many of the compounds listed in Table 7 are toxic, unsaturated blood substitute analogs such as 1,2-bis(perfluoromethyl)ethylene and tetris(perfluoromethyl)-ethylene are presented as possible non-toxic alternatives.

C. Robin

Robin discloses that completely fluorinated, saturated C_2, C_3 and C_4 compounds are efficient, non-ozone-depleting fire extinguishing agents used alone or in blends with other compounds in total flooding and portable systems (Abstract). Robin does not disclose any unsaturated fluorocarbons, much less octafluoro-2-butene.

D. Preliminary Amendment and Declaration filed on February 10, 1998

In the Declaration attached to the Preliminary Amendment filed on February 10, 1998, Mr. Lawrence Grzyll, a co-Applicant of the present invention, pointed out that the published literature suggests that hexafluoropropene may be toxic and thus not suitable for fire suppression. Sax et al., "Dangerous Properties of Industrial Materials," 7th ed. (1984), assign a hazard rating of 3 to hexafluoropropene compared to a hazard rating of 1 for octafluoro-2-butene. The 4-hour LC_{50} for hexafluoropropene is 1673 (rat). The LC_{10} for octafluoro-2-butene is 6100 ppm (rat). The LC_{50} is higher than the LC_{Lo} by definition. Thus, hexafluoropropene is at least 3.6 times more toxic than octafluoro-2-butene. The

Preliminary Amendment and Declaration simply confirm what is disclosed on pages 132-133 of Pitts.

IV. ISSUE ON APPEAL

The sole issue on appeal is whether a method for extinguishing a fire using a fire extinguishing composition consisting essentially of octafluoro-2-butene is rendered obvious by a combination of references that provide no teaching, suggestion or motivation to use octafluoro-2-butene as a fire extinguishing agent.

V. GROUPING OF CLAIMS

Each claim of this patent application is separately patentable, and upon issuance of a patent will be entitled to a separate presumption of validity under 35 U.S.C. §282. For convenience in handling this Appeal, the claims are grouped as follows:

Group I, Claims 27 and 8-13;

Group II, Claim 28 and 31; and

Group III, Claims 29-30 and 32-33.

Groups I-III will be argued separately in the following arguments by representative claims within each group. The groups do not stand or fall together.

VI. ARGUMENT

A. The Cited References In Combination Do Not Teach Or Suggest the Claimed Invention

JP '230, Pitts and Robin do not teach or suggest a method of extinguishing a fire using a fire extinguishing composition consisting essentially of octafluoro-2-butene, as recited in Claim 27 (Group I) or a combination of octafluoro-2-butene and

other fire extinguishing agents such as octafluoro-1-butene, as recited in Claims 28 and 31 (Group II).

JP '230 does not disclose octafluoro-2-butene or octafluoro-1-butene. Although JP '230 generically discloses unsaturated carbon fluorides with 3-4 carbon atoms, one of ordinary skill in the art would have been led to practice saturated carbon fluorides (e.g., $CF_3CF_2CF_3$, octafluorocyclobutane) or hydrofluorocarbons because these compounds are shown in Table 1 to have lower fire extinguishing concentrations (FEC) than hexafluoropropene, the only disclosed unsaturated carbon fluoride.

1. Any Combination of JP '230, Pitts and Robin Would Have Led to the Use of A Non-toxic Blood Substitute or A Saturated Carbon Fluoride

Neither Pitts nor the Preliminary Amendment and Declaration overcome the deficiencies of JP '230. The Examiner asserted that Pitts "directly teaches . . . octafluoro-2-butene . . . as a potentially effective fire-extinguishing agent[s]" (Final Rejection at page 4). However, upon review of Pitts, one of ordinary skill in the art would have been led away from using octafluoro-2-butene.

First, as noted above, Pitts clearly indicates a preference for brominated compounds, which is contrary to the teaching of JP '230. A reference must be considered not only for what it expressly teaches, but also for what it fairly suggests. Second, Pitts teaches that perfluoroisobutene, an isomer of octafluoro-2-butene, is a deadly poison and that consideration should be given to possible conversion to this toxic isomer when studying octafluoro-2-butene (see pages 55 and 133). Pitts and the Preliminary Amendment and Declaration

filed on February 10, 1998, merely disclose that octafluoro-2-butene is less toxic than hexafluoropropene.

Because Pitts teaches a preference for brominated compounds and indicates that a poisonous isomer may result from the use of octafluoro-2-butene, one of ordinary skill in the art would not have substituted octafluoro-2-butene for the hexafluoropropene or hexafluoroisobutene disclosed in JP '230 in view of Pitts. Any combination of JP '230 and Pitts would have led one of ordinary skill in the art to substitute the non-toxic blood substitute analog 1,2-bis(perfluoromethyl)ethylene (i.e., $CF_3CH=CHCF_3$), not octafluoro-2-butene, for the hexafluoropropene or hexafluoroisobutene of JP '230. JP '230 discloses using such unsaturated halogenated hydrocarbons with 3-4 carbon atoms and a double bond replaced with fluorine (translated numbered paragraph [0007]).

Robin does not overcome the deficiencies of JP '230 and Pitts. Robin only discloses saturated, not unsaturated, compounds as fire extinguishing agents. Thus, any combination of JP '230 and Robin would have led one of ordinary skill in the art to use a saturated carbon fluoride in a total flooding or portable system. As noted above, JP '230 discloses that saturated carbon fluorides have a lower FEC than hexafluoropropene.

2. "Obvious to Try" is An Incorrect Standard for Determining Obviousness

Obviousness cannot be established by combining the teachings of the prior art to produce the claimed invention, absent some teaching, suggestion or incentive supporting the combination. In re Geiger, 2 USPQ2d 1276, 1278 (Fed. Cir. 1987) (noting that the standard for §103 is not that one

skilled in the art might find it obvious to try various combinations of known scale and corrosion prevention agents). An invention is obvious to try where the prior art gives (1) either no indication of which parameters are critical or (2) no direction as to which of many possible choices is likely to be successful. Merck & Co. Inc. v. Biocraft Laboratories, 10 USPQ2d 1843, 1845 (Fed. Cir. 1989). Pitts merely recommends certain compounds, in particular brominated unsaturated compounds and non-toxic blood substitute analogs, for future study. Pitts does not state that octafluoro-2-butene is usable or has been usable as a fire extinguishing agent. Although Pitts may pique the scientist's curiosity such that further investigation might be done as a result of the disclosure, Pitts does not contain a sufficient teaching that the claimed result would be obtained if this direction were pursued. In re Eli Lilly & Co., 14 USPQ2d 1741, 1743 (Fed. Cir. 1990).

The rejection of Claim 27 (Group I) and Claim 31 (Group II) over JP '230 in view of Pitts and Robin is based upon obvious to try reasoning and thus is improper.

3. Octafluoro-2-butene Shows Surprising and Unexpected Results As compared to Hexafluoropropene

Further, octafluoro-2-butene shows surprising and unexpected results as a fire extinguishing agent in comparison to hexafluoropropene. A Declaration of Mr. Grzyll filed on November 3, 1998, shows that octafluoro-2-butene has a FEC of 4.7% (v/v). In contrast, hexafluoropropene has a FEC of 6.1 % (v/v).

Although the Examiner acknowledged that the FEC of octafluoro-2-butene is superior to that of hexafluoropropene, he maintained that such results are not unexpected in view of the estimated heat capacity data in Table 7 of Pitts and the FEC data for the saturated carbon fluoride analogs of Robin.

Piecing together such data to render the claimed methods obvious ignores the underlying teaching of the references and is based upon hindsight reasoning. That one can reconstruct and/or explain a theoretical mechanism of an invention by means of logic and sound scientific reasoning does not afford the basis for an obviousness conclusion unless that logic and reasoning also supplies sufficient impetus to have led one of ordinary skill in the art to combine the teachings of the references to make the claimed invention. Ex parte Levengood, 28 USPQ2d 1300, 1302 (Bd. Pat. App. & Int. 1993). As noted above, any combination of the cited references would have led one of ordinary skill in the art to use (1) the non-toxic blood substitute analog 1,2-bis(perfluoromethyl)ethylene, which has a similar heat capacity to that of octafluoro-2-butene, or (2) a saturated carbon fluoride having a lower FEC than hexafluoropropene as a fire extinguishing agent.

B. The Claimed Fire Streaming Methods Shows Surprising and Unexpected Results

Octafluoro-2-butene shows particularly unexpected and surprising results in streaming applications. None of the references, alone or in combination, teaches or suggests extinguishing a fire by streaming a composition consisting essentially of octafluoro-2-butene, as recited in Claim 29 (Group III).

A Declaration of Mr. Grzyll filed on September 9, 1998, demonstrates that FEC data cannot be used to determine the efficacy of fire extinguishing agents for streaming applications. Cup burner flame-extinguishing concentrations (FEC's) are used to rank agents for total flooding applications. In contrast, minimum application density (flow rate/fire surface area) is used to rank agents for streaming applications.

This difference in determining the efficacy for fire extinguishing agents to be used in total flooding and streaming applications is known to those of ordinary skill in the art, as shown by the journal article: Skaggs, "Advanced Streaming Agent Program," Halon Options Technical Working Conference (1994) ("Skaggs"). Skaggs states:

> As previously mentioned, it was determined during earlier research that the cup burner value is not always an appropriate parameter for ranking streaming agent replacement candidates. Streaming agent variables not taken into account by the cup burner method include: agent discharge container, nozzles, techniques of firefighter personnel, flow rates, discharge pattern, varying discharge rate as container volume changes, container fill density, and timing of the test. . . . Several compounds were tested ... and results showed that the cup burner extinguishing concentration was of limited value in ranking streaming agents.

Page 323, emphasis added.

JP '230 discloses that some fire extinguishing agents can contain a gaseous jet agent to promote release of the fire extinguishing agent from a fire extinguisher (numbered paragraph [0025]). However, hexafluoropropene and hexafluoroisobutene are not shown in Tables 2-3. Similarly, although Robin discloses possible streaming applications, Robin only discloses FEC data in Tables 1-2. Further, the

only example of using the perfluorocarbons disclosed in Robin is in a total flooding system, as shown in Example 3.

Because none of the cited references teaches or suggests octafluoro-2-butene as an efficient fire extinguishing agent and Applicants have demonstrated the inapplicability of FEC data to determine the efficacy of fire extinguishing agents in streaming applications, the claimed method of introducing octofluoro-2-butene to a fire by streaming would not have been obvious in view of the cited references, alone or on combination.

VII. CONCLUSION

For all the reasons discussed above, it is respectfully submitted that it would not have been obvious to a person of ordinary skill in the art, at the time the invention was made, to practice the claimed invention in view of the cited references, alone or in combination.

For all of the above reasons, Appellants respectfully request this Honorable Board to reverse the rejection of Claims 8-13 and 27-33.

This Appeal Brief is accompanied by a check in the amount of $150.00 in payment of the required appeal fee. This amount is believed to be correct, however, the Commissioner is hereby authorized to charge any deficiency, or credit any

overpayment, to Deposit Account No. 05-1323 (Docket #132/42381CO). A triplicate copy of this Appeal Brief is attached.

Respectfully submitted,

May 25, 1999

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APPENDIX

8. The method of claim 27, wherein the step of introducing comprises total flooding.

9. The method of claim 27, wherein the step of introducing occurs in an enclosed region.

10. The method of claim 27, wherein the step of introducing includes using an inert gas to pressurize the composition sufficiently to maintain an adequate flow of the composition toward the fire.

11. The method of claim 27, wherein the composition has low thermal stability.

12. The method of claim 27, wherein the fire extinguishing composition has a residue of no more than about 1.00% (w/w).

13. The method of claim 27, wherein the fire extinguishing composition is compatible with metals and nonmetals.

27. A method of extinguishing a fire, comprising the steps of introducing to the fire a fire extinguishing composition consisting essentially of octafluoro-2-butene and maintaining a concentration of the fire extinguishing composition sufficient to extinguish the fire.

28. A method of extinguishing a fire as defined in Claim 27, wherein the composition further includes a mixture of conventional fire extinguishing agents.

29. The method of Claim 27, wherein the step of introducing comprises streaming.

30. The method of Claim 29, wherein the streaming comprises providing the composition in a portable fire extinguisher.

31. The method of Claim 27, wherein the composition further comprises octafluoro-1-butene.

32. The method of Claim 30, wherein the step of introducing further comprises pressurizing the composition with an inert gas, thereby maintaining a flow of the composition toward the fire.

33. The method of Claim 30, wherein, after streaming, the composition has a residue of no more than about 1.00 w/w %.